"Together we enjoy, aspire, create & achieve"

Parent Handbook: Mathematics

Content

Multiplication

There are two methods we use with pupils and encourage students to use the one they feel most comfortable with.

Method 1 – Grid Method

We split numbers into place value sections.

For example; 23 x 42 becomes 20 and 3 x 40 and 2:

X	20	3
40		
2		

Pupils complete the grid by multiplying the numbers and fill in the boxes. If pupils struggle with their times tables, we cover the zeros, get them to multiply the single digits and then put the zeros on after.

X	20	3
40	800	120
2	40	6

```
    800
+   120
+    40
+     6
  -----
    966
```

Pupils know to add the numbers they have found through multiplication.

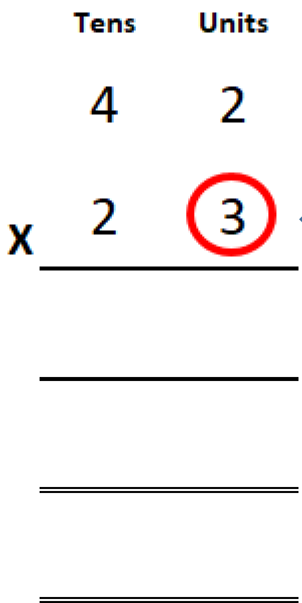
This is the most common place for errors.

Pupils often make addition errors after successfully multiplying the numbers.

Method 2 – Column Multiplication

We line numbers up according to place value.

For example:

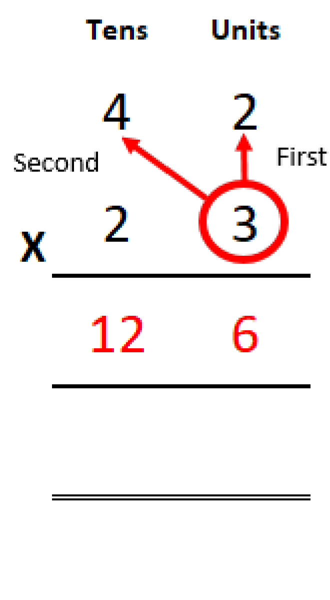


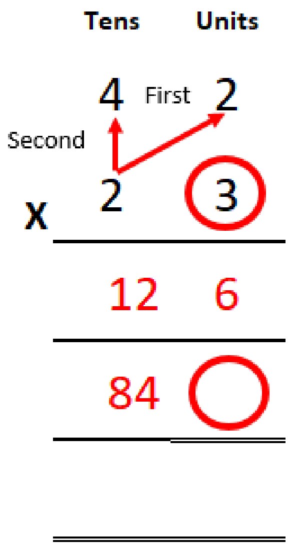
We circle the bottom unit to highlight this is the start point to pupils.

This also serves as a reminder that the 2 in 23 is a 20 and not just a 2!

We multiply the unit on the top line by the circled unit. Next we multiply the tens on the top line by the circled unit.

We do this in order to be able to carry forward any tens we may make with the multiplication of the units.



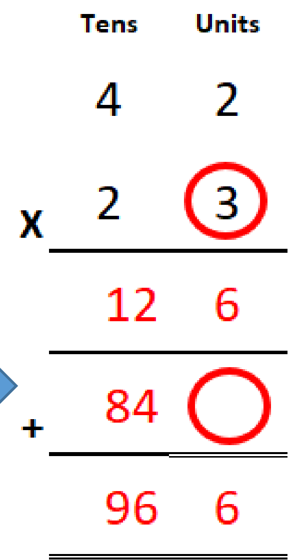


We repeat the process with the tens column AFTER we have put a zero in the units column. This zero comes from the circled unit we originally drew for our start point.

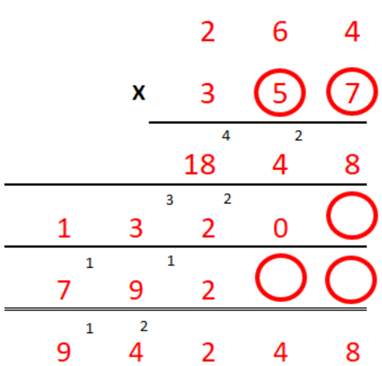
This allows us to treat the 2 digit in 23 as a 2 now rather than a 20 (Dropping the zero means we already have multiplied by a factor of 10)

Having completed all multiplications we can now add the two rows of working.

The column method reduces errors we see in the grid method with column addition as the numbers are already lined up.



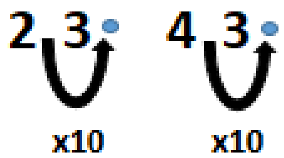
The same rules are used when multiplying bigger digits. We just must remember to drop more zeros to accommodate the bigger values. For example:



Multiplying Decimal Numbers

When multiplying decimal numbers we ask pupils to remove decimal points. For example:

2.3 x 4.2 becomes 23 and 42 by multiplying both numbers by 10:

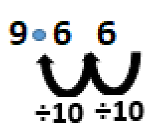


We then complete the multiplication as normal, using the preferred method of the pupil.

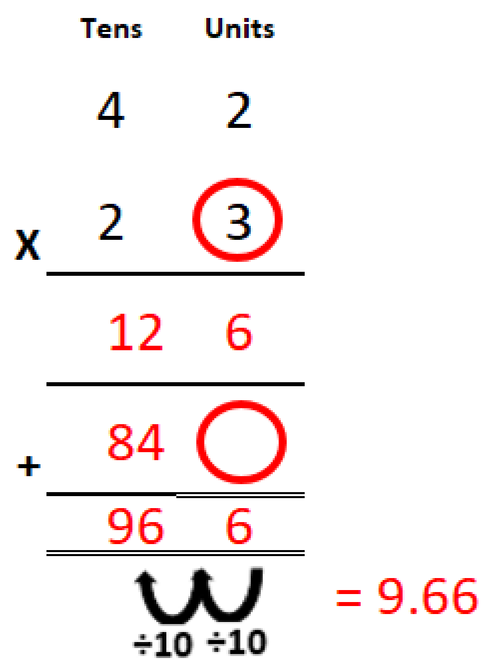
Method 1 – Grid

X	20	3
40	800	120
2	40	6

800
+ 120
+ 40
+ 6
966



Method 2 - Column



As we multiplied BOTH numbers by 10 we must divide the answer twice by 10 in order to replace the decimal.

(If there were two digits behind decimals in the question there MUST be two behind the decimal in the answer)

Division

The only division method we use with pupils is short division. Often referred to as the bus stop method.

The key here is the number you are <u>DIVIDING BY</u> goes <u>OUTSIDE</u> the bus stop:

672 ÷ 4 is set up as:

$$4\,\overline{)\,6\quad 7\quad 2\,}$$

We start by seeing how many times 4 goes into 6 (6÷4). Any remainders are carried onto the next digit under the bus stop:

$$\begin{array}{rl} & \;\;1 \\ 4 & \overline{)\,6\quad {}^{2}7\quad 2\,} \end{array}$$

so the 7 has now become 27.

Again we divide this by the 4 and carry any remainders:

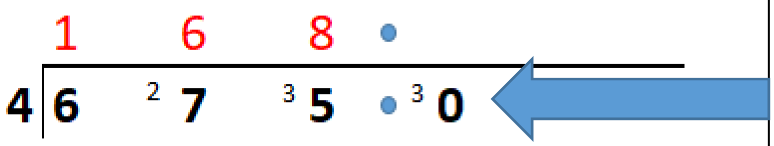
$$\begin{array}{rl} & \;\;1\quad\;\; 6 \\ 4 & \overline{)\,6\quad {}^{2}7\quad {}^{3}2\,} \end{array}$$

now the 2 has become 32.

We complete the division, again dividing by 4:

$$\begin{array}{rl} & \;\;1\quad\;\; 6\quad\;\; 8 \\ 4 & \overline{)\,6\quad {}^{2}7\quad {}^{3}2\,} \end{array}$$

The same rules apply, even if your answer becomes a decimal.

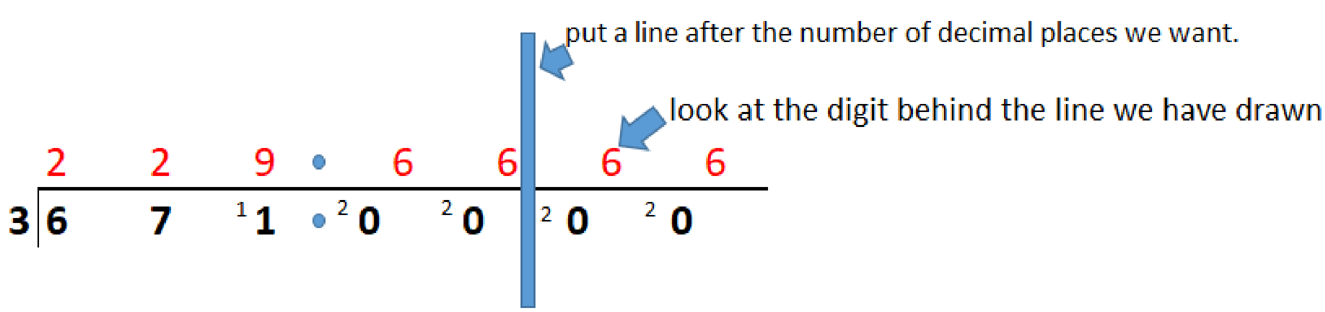


Because 4 does not go into 35 completely we insert a decimal point. After the decimal point we put a zero and continue to carry any remainders.

We complete the division using the same method.

If the division continues for longer than 4 decimal places we would usually ask the pupil to stop and round their answer.

to 2 decimal places would be:



If the digit behind the line is 5, 6, 7, 8 or 9 we round up the digit in front of the line by 1. If the digit behind the line is 0, 1, 2, 3 or 4 we leave the number in front of the line alone.

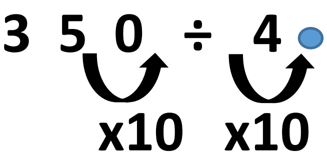
S0 the answer here would be 671 ÷ 3 = 229.67.

Division by Decimals

Division by decimals is challenging, so in order to make it easier, we convert the number we are dividing by to an integer (whole number).

So 35 ÷ 0.4 becomes 350 ÷ 4.

We have multiplied both numbers by 10:



We have to multiply both numbers by 10 in order to keep the calculation in proportion. (This means we do not have to divide the answer by 10 at the end)

0 8 7 • 5

4 | 3 ^{3}5 ^{3}0 • ^{2}0

So 35 ÷ 0.4 = 87.5 because 350 ÷ 4 = 87.5.

Fractions

Fractions are part of a whole number:

$$\frac{5}{6} \quad \begin{array}{l}\text{Numerator} \\ \text{Denominator}\end{array}$$

One key item that pupils often forget is that the line in a fraction means divide.

This is key when converting fractions to decimals as pupils know to use the bus stop method, but as highlighted in the division section struggle to remember which one goes outside the bus stop.

So $\frac{5}{6}$ **is 5 ÷ 6 which would be**

$$\begin{array}{r|l} & 0\;.\;8\;\;3\;\;3 \\ \hline 6 & 5\;.\;{}^{5}0\;{}^{2}0\;{}^{2}0 \end{array}$$

Simplifying Fractions

When simplifying fractions we look for common factors that can be used to divide into the numerator and denominator. This process can be done more than once in order to establish 'the simplest form':

$$\frac{24}{36} \xrightarrow{\div 12} \frac{2}{3} \quad \text{or} \quad \frac{24}{36} \xrightarrow{\div 2} \frac{12}{18} \xrightarrow{\div 2} \frac{6}{9} \xrightarrow{\div 3} \frac{2}{3}$$

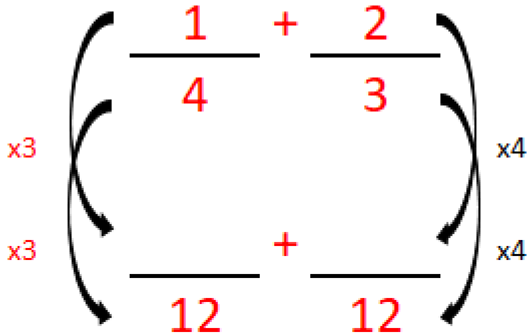
<u>Adding and Subtracting Fractions</u>

The key rule with adding and subtracting fractions is that you can only complete the calculation, if the denominators are the same. We use <u>equivalence</u> to ensure this happens.

$$\frac{1}{4} + \frac{2}{3}$$

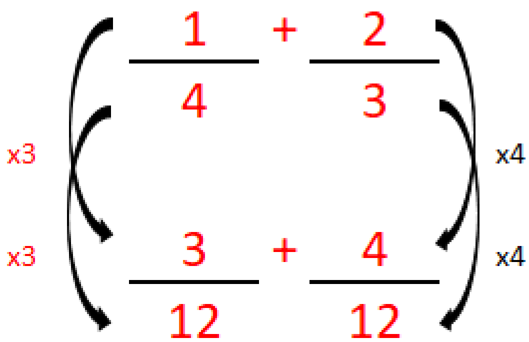
We multiply the denominators to find a common denominator.

So 4 x 3 = 12 which will be our new denominator.



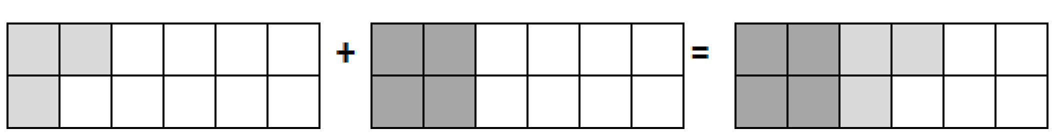
Whatever we have multiplied the original denominator by to get the new one, must also multiply the numerator to ensure equivalence.

We can then complete the calculation



$$\frac{3}{12} + \frac{4}{12} = \frac{7}{12}$$

We often use diagrams to help pupils recognize we only add the numerators once we have a common denominator:



<u>**Multiplying Fractions**</u>

This is the easiest rule to remember with fractions.

We multiply the two numerators and two denominators to give us our answer:

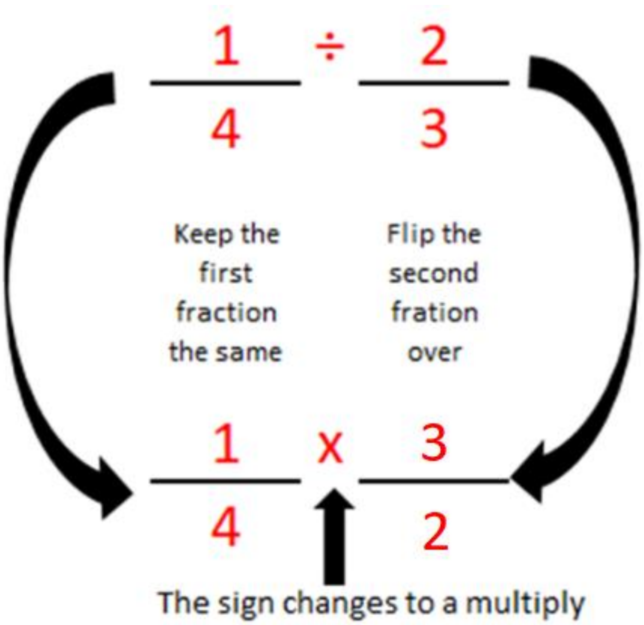
$$\frac{1}{4} \times \frac{2}{3} = \frac{2}{12}$$

We can then simplify our answer:

$$\frac{1}{4} \times \frac{2}{3} = \frac{2}{12} \xrightarrow[\div 2]{\div 2} \frac{1}{6}$$

<u>**Dividing Fractions**</u>

Another tricky concept so we change the sum to make it easier:



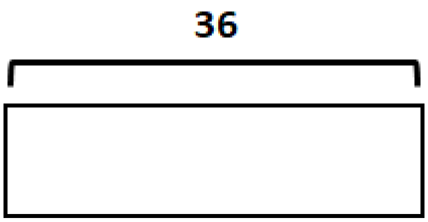
As we have now made the sum a multiply we can use the easy rule above to complete the calculation:

$$\frac{1}{4} \times \frac{2}{3} = \frac{2}{12}$$

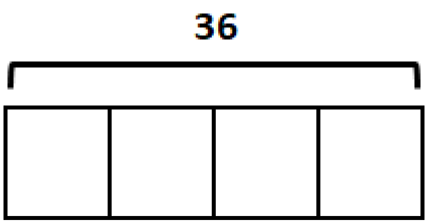
Fraction of an Amount

We have introduced bar modelling to support pupils understanding of certain topics. Fraction of an amount is one of these topics. For example:

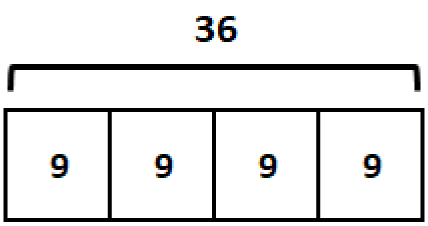
If we want to find ¾ of 36 first we draw a bar which represents 36:



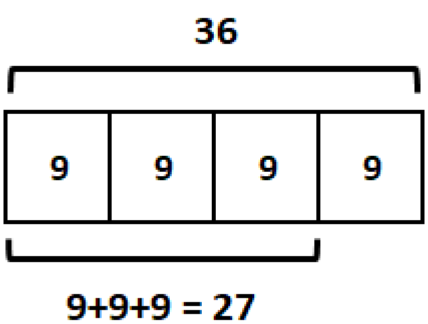
We then split this bar into 4 equal pieces:



36 ÷ 4 = 9 so we fill in the boxes:



Because we want ¾ we count 3 boxes up:



so ¾ of 36 is 27

As pupils gain more confidence with this concept thy rely less on the bar and more on the process of dividing by the denominator and multiplying the result by the numerator.

Negative Rules

Pupils seem to have a problem with negative calculations but need to learn the rules in KS3 to support more tricky calculations in KS4, with topics such as algebra.

Multiplying and Dividing:

-	x	-	=	+
+	x	-	=	-
-	x	+	=	-

-	÷	-	=	+
+	÷	-	=	-
-	÷	+	=	-

When we multiply or divide two negatives, the negatives cancel each other out so our answer is a positive.

If the signs are different then then answer has to be a negative.

Adding and subtracting:

When adding and subtracting it is the signs <u>NEXT</u> to each other that determine whether we add or subtract:

$$3 \quad + \quad - \quad 4 \quad = \quad -1$$

if you add a negative it is the same as subtracting

$$3 \quad - \quad - \quad 4 \quad = \quad +7$$

if you subtract a negative we 'take away' the negative

this leaves us with a positive so we add the numbers

(If the first number in a calculation is a negative this has no bearing on these rules. The same rules always apply.)

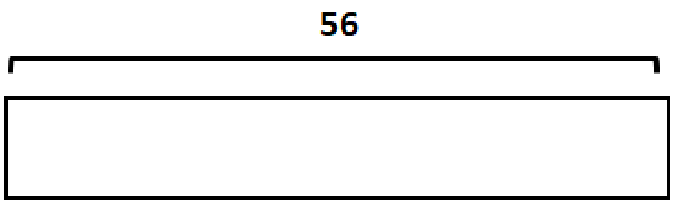
Ratio of an Amount

As with fraction of an amount we use bar modelling.

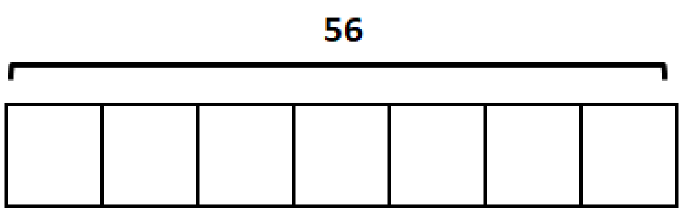
For Example:

Split 56 in the ratio 5:2.

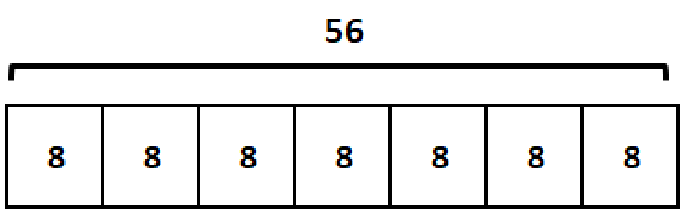
First we draw a bar representing 56:



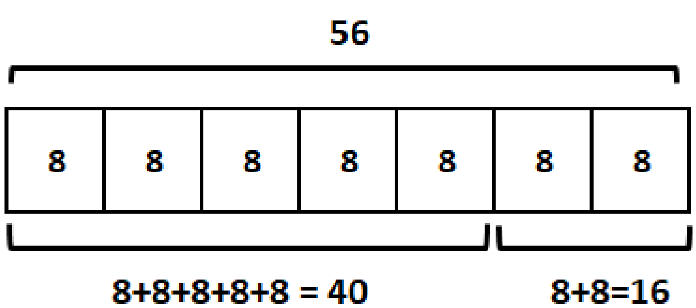
By adding the two parts of the ratio together we find the total number of parts; 5+2=7 so we split the bar into 7 equal parts.



56 ÷ 7 = 8 so we fill in the boxes



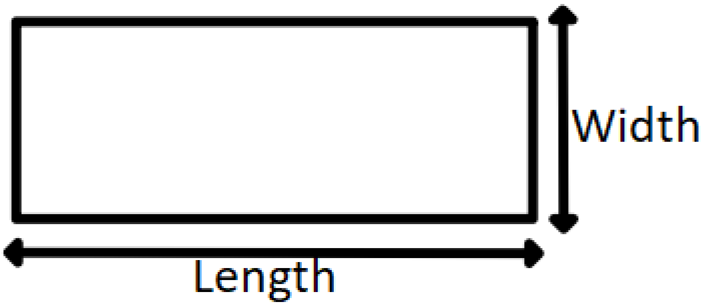
We split the boxes into 5:2



So 56 split into the ratio 5:2 is 40:16. As a check we can add the parts of the new ratio and should get back to the original amount; 40+16 = 56.

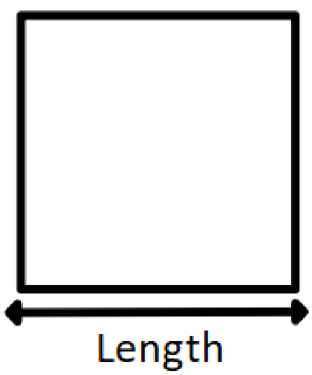
Area Formulas

Pupils are required to know all shape area formulas. These are no longer given on KS4 tests so the sooner they can retain them, the easier their work will become.



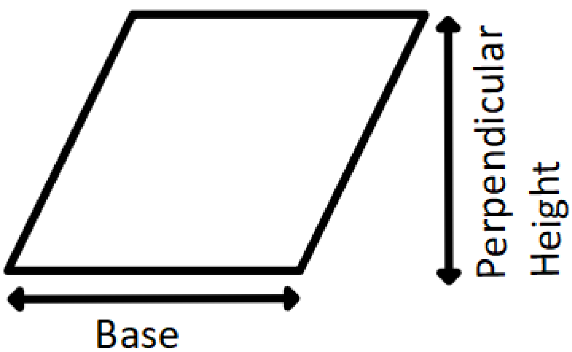
Rectangle:

Area = length x width



Square:

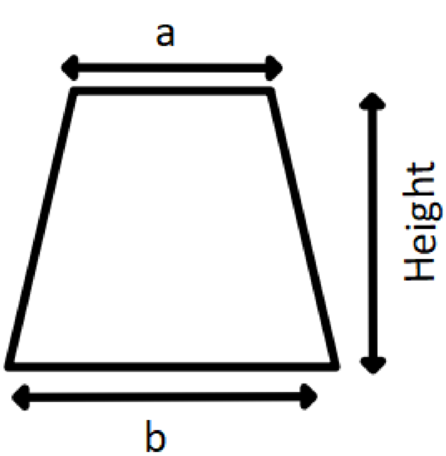
Area = length x length
or length²



Parallelogram and Rhombus:

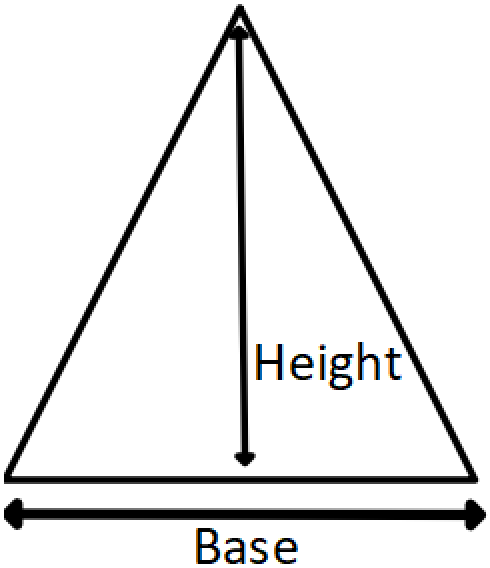
Area = base x height

(Note this is perpendicular height and not the slant height)



Trapezium

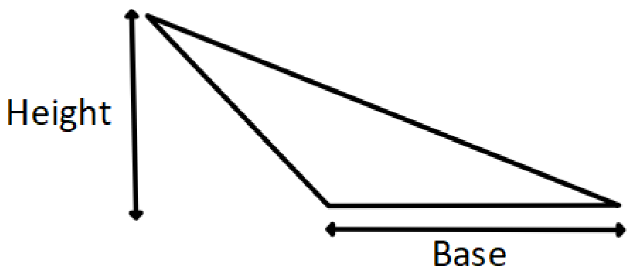
$$\text{Area} = \frac{(a + b) \times \text{height}}{2}$$

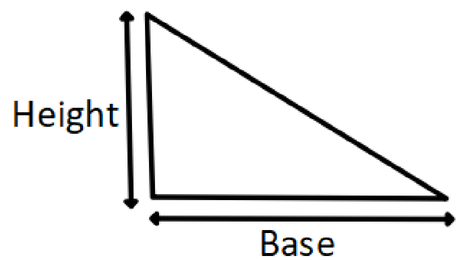


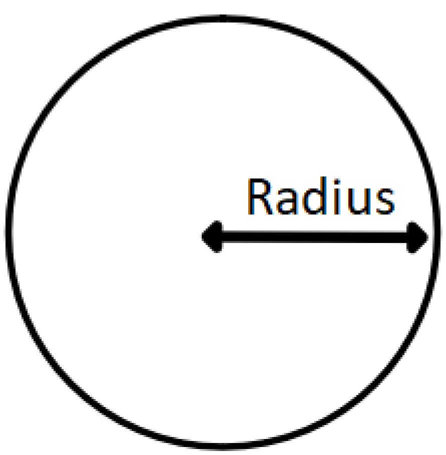
Triangle:

$$\text{Area} = \frac{(\text{base x height})}{2}$$

(Note the height can also be outside the triangle, see additional diagrams)







Circle

Area = Πr^2

Step 1: Find the radius

Step 2: Square it

Step 3: Multiply it by Π

*(If the diameter is given, we half this to find the radius)

Notes

Notes